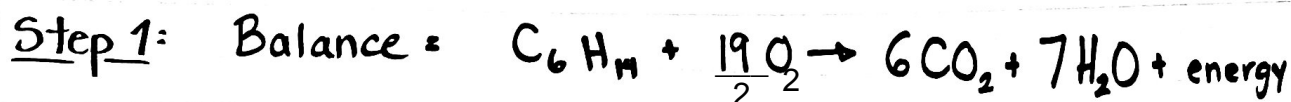


Molar Heat of Combustion of Hexane

Question:



Step 2: Givens :
n of Hexane = 0.315 mol
V of water = 5.65 L
 ΔT of water = 55.4°C
C of water = 4.184 J/g°C
Molar heat of hexane = ?

If I burn 0.315 mol of hexane in a bomb calorimeter containing 5.65 L of water and it made the water temperature rises by 55.4 degrees Celsius, what is the molar enthalpy of combustion of hexane?

Step 3: Finding : $Q = mc\Delta T$

Heat Gain $\Delta T = 55.4^\circ C$

$$C_w = 4.184 \text{ J/g}^\circ C$$

$$V = 5.65 \text{ L} \quad \therefore M_w = 5650 \text{ g (1g/mL)}$$

Step 4: $Q_{\text{surrounding}} = 5650 \times 4.184 \times 55.4$
 $= 1.31 \times 10^6 \text{ J}$

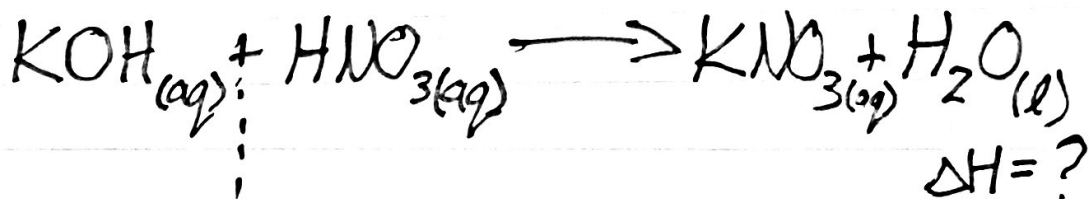
Step 5: $\Delta H_{\text{system}} = -Q_{\text{surrounding}}$
 $= -1.31 \times 10^6 \text{ J}$

Step 6: Ratios of $\Delta H \rightarrow \text{mol}$ $\left(\frac{\Delta H_1}{n_1} = \frac{\Delta H_2}{n_2} \right)$

Step 7: $\frac{-1.31 \times 10^6 \text{ J}}{0.315 \text{ mol}} = \frac{\Delta H}{1}$

Step 8: Calculate : $\Delta H_{\text{of Combustion}} = -4.16 \times 10^3 \text{ kJ/mol}$

Fig 311 #8 Pete & Cole



$$T_i = 21.01^\circ\text{C}$$

$$T_f = 21.34^\circ\text{C}$$

$$\Delta T = +0.33^\circ\text{C}$$

Volume: 100mL (V)	100mL
----------------------	-------

Concentration: 0.05 mol/L (C)	0.05 mol/L
----------------------------------	------------

$$\eta = V \times C : 0.1\text{L} \times 0.05 \frac{\text{mol}}{\text{L}}$$

$$= \underline{0.005 \text{ mol}} = \underline{0.005 \text{ mol}}$$

a) $Q_{\text{surroundings}} = m_{\text{water}} C_{\text{water}} \Delta T$

$$= 200\text{g} (4.19 \text{ J/g}^\circ\text{C}) (0.33^\circ\text{C})$$

$$= 276.54 \text{ J}$$

$$\therefore Q_{\text{system}} = -276.54 \text{ J}$$

$$\Delta H = \frac{Q}{\eta}$$

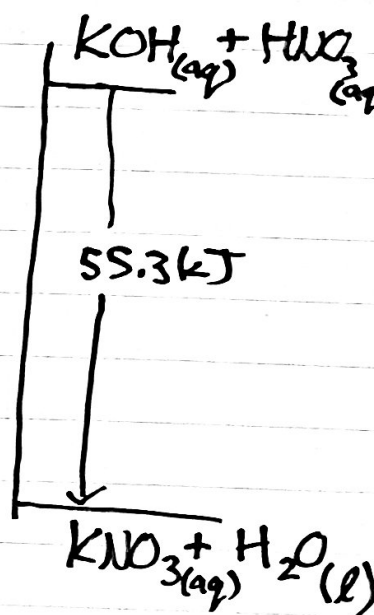
$$= \frac{-276.54 \text{ J}}{0.005 \text{ mol}}$$

$$= \underline{-55308 \text{ J/mol}}$$

\therefore Molar Enthalpy is approx. -55.3 kJ/mol

b)

Energy
 $\Delta H(\text{kJ})$



P. 205 - #27

Marg
Luttrell

$$\Delta H = -55.0 \text{ kJ/mol}$$

$$V_{\text{NaOH}} = 0.250 \text{ L} \rightarrow \therefore n = 0.0250 \text{ mol}$$

$$\text{conc. NaOH} = 0.100 \text{ mol/L}$$

$$C_{\text{H}_2\text{O}} = 4.184 \text{ J/g}^\circ\text{C}$$

$$\Delta T = ?$$

~~$$Q_{\text{syst}} = -Q_{\text{surrnd}}$$
$$Q_{\text{surr}} = 55.0 \text{ kJ}$$~~

$$\Delta H = \frac{Q}{n}$$

$$\Delta H_{\text{syst}} = -\Delta H_{\text{surr}}$$

$$\Delta H_{\text{surr}} = 55 \text{ kJ/mol}$$

$$55.0 = \frac{mc\Delta t}{n}$$

$$55.0 = \frac{(0.250)(4.184)\Delta t}{0.0250}$$

$$\Delta t = 1.31^\circ\text{C}$$

The water gained
1.31°C.

If I burn 22.0 g of propane in a bomb calorimeter containing 3.25 liters of water, what is the molar heat of combustion of propane if the water temperature rises 29 degrees Celsius?

KERR
HAMZE
FARDOWS
SAARA

TO FIND ΔH :

GIVEN :

$$m_{C_3H_8} = 22.0 \text{ g}$$

$$V_{H_2O} = 3.25 \text{ L}$$

$$m_{H_2O} = 3.25 \text{ L} \times 1000 \frac{\text{mL}}{\text{L}} \\ = 3250 \text{ mL} = \boxed{3250 \text{ g}}$$

$$\Delta T = 29.5^\circ\text{C}$$

Specific Heat
Capacity for $H_2O = 4.184 \text{ J/g}^\circ\text{C}$

$$\begin{aligned} \textcircled{1} \quad Q &= mc\Delta T \\ &= (3250 \text{ g})(4.184 \text{ J/g}^\circ\text{C})(29.5^\circ\text{C}) \\ &= 401141 \text{ J} \end{aligned}$$

$$\text{Convert to kJ} = \boxed{401.1 \text{ kJ}} \rightarrow Q_{\text{surrounding}}$$

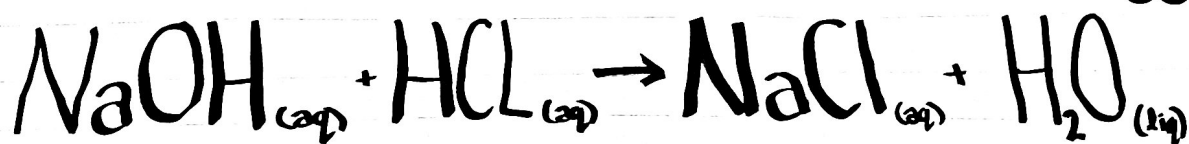
$$\textcircled{2} \quad M_{C_3H_8} = 44.11 \text{ g/mol}$$

$$Q_{\text{system}} = -401.1 \text{ kJ}$$

$$\begin{aligned} \textcircled{3} \quad n &= \frac{m}{M} \\ &= \frac{22.0 \text{ g}}{44.11 \text{ g/mol}} \\ &= \boxed{0.4988 \text{ mols}} \end{aligned}$$

$$\begin{aligned} \textcircled{4} \quad \Delta H &= \frac{-401.1 \text{ kJ}}{0.4988 \text{ mols}} \\ &= \boxed{-804 \text{ kJ/mol}} \end{aligned}$$

#26.



$$\begin{array}{lll} \downarrow & \downarrow & \\ V: 150.0 \text{ mL} & V: 150.0 \text{ mL} & \text{initial temp: } 25.00^\circ\text{C} \\ C: 1.000 \text{ mol/L} & C: 1.000 \text{ mol/L} & \text{final temp: } 30.00^\circ\text{C} \end{array}$$

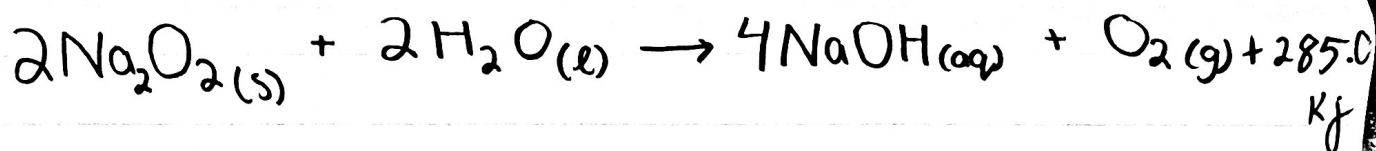
$$\begin{aligned} Q &= mc\Delta T \\ &= (300 \text{ g})(4.19 \text{ J/g}\cdot^\circ\text{C})(30.00^\circ\text{C} - 25.00^\circ\text{C}) \\ &= 6285 \text{ J} \end{aligned}$$

$$\begin{aligned} n &= cV \\ &= (1.000 \text{ mol/L})(150 \text{ mL})\left(\frac{1 \text{ L}}{1000 \text{ mL}}\right) \\ &= 0.15 \text{ mol} \end{aligned}$$

$$\begin{aligned} \Delta H &= -Q/n \\ &= \frac{-6285}{0.15} \\ &= -41900 \text{ J/mol} \\ &= -41.9 \text{ kJ/mol} \end{aligned}$$

The enthalpy of the reaction is -41.9 kJ/mol .

#29 P305



Given:

$$\Delta H^\circ = -285.0 \text{ kJ}$$

$$m_{\text{Na}_2\text{O}_2} = 7.800 \text{ g}$$

$$m_{\text{H}_2\text{O}} = 110 \text{ mL} = 110 \text{ g}$$

$$(4) \Delta H = -Q$$

$$-14,254 \text{ J} = 14,254 \text{ J}$$

Required: ΔT

(1) Calculate Molar Mass

$$\text{Na}_2\text{O}_2 = 77.98 \text{ g/mol}$$

$$\text{Na} \quad 2 \times 22.99 = 45.98$$

$$\text{O} \quad 2 \times 16.00 = 32$$

$$\hline 77.98$$

(2) Calculate Moles

$$n = m/M \quad 0.10003 \text{ mol}$$

$$n_{\text{Na}_2\text{O}_2} = \frac{7.8}{77.98}$$

$$= 0.10003 \text{ mol}$$

(3) Finding ΔH for Na_2O_2

$$\frac{-285.0 \text{ kJ}}{2 \text{ mol}} = \frac{\Delta H}{0.10003 \text{ mol}}$$

$$-14.254 \text{ kJ} = \Delta H$$

$$\rightarrow \Delta H = -14,254 \text{ J}$$

(5) Solving for ΔT

$$Q = mc\Delta T$$

$$14,254 \text{ J} = (110 \text{ g})(4.18)(\Delta T)$$

$$\Delta T = \frac{14,254 \text{ J}}{110 \text{ g} \times 4.18}$$

$$\Delta T = 30.97^\circ\text{C}$$

Zunaira
Rawan